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BIOLOGICAL CHARACTERISTICS OF HIGH-OLEIC SUNFLOWER OIL

Breeding of new sunflower varieties supplying oil with differing fatty acids composition is very interesting and promising from a dietological point of view. The production of several types of the oil's fatty acid spectrum is promising because these types will surely have different oxidation resistance in storage and different applications in the food industry and technology.

The Food Research Institute has undertaken a comparative study of biological characteristics of oil produced from a high-oleic sunflower variety bred at the All-Union Research Institute of Oil Crops, and from the ordinary regionalised Voskhod variety. During the three months' experiment, young albino rats got adequate food rations of equal calorific value a third of which was made up by fats. The check group of rats had lard mixed with sunflower oil, with linoleic acid making 4.25% of the ration's calorific value. The diet, with its constant concentration of this irreplaceable fatty acid, is stable in all our research, making it possible to compare the nourishing effect of various fats using the index of fats' nourishing effect (IFN), which is calculated according to this formula:

$$IFN = \frac{W_{ex}}{W_{st}} \times 100,$$

where W_{ex} is the weight increase of the rats fed on the fat in question, and W_{st} - that of the rats fed on the standard mixture of lard and sunflower oil, whose IFN is considered to be

100%. Table 1 illustrates the fatty acid composition of the sunflower oil brands under study and of the lard-and-oil check diet.

Table 1

Fatty Acid Composition of Fat Products Under Study (%)

Fatty acids	Voskhod variety sunflower oil	High-oleic variety sunflower oil	Fats contained in check diet
14:0	-	-	6.32
16:0	5.80	3.10	22.80
16:1	-	-	1.23
18:0	3.80	3.30	6.90
18:1	22.60	70.10	38.10
18:2	67.80	23.50	22.30
18:3	traces	-	1.03
20:1	-	-	1.31
20:4	-	-	traces

Rats fed on a diet with reduced albumen concentration (12% of calories) were also experimented upon. Data were taken both on their size and weight and on biochemical characteristics of their metabolism. Special attention was paid to evaluating the influence by high-oleic oil on a major function of fats in diet - synthesizing polyenic fatty acids (with 20 and 22 carbon atoms) which are structural elements of biologic membranes. We evaluated this function by a new index, metabolisation coefficient of essential fatty acids (CEM). The rats' weight increase showed that both oils were equally nourishing. The check group

did not differ considerably from them, either. IFN calculation proved but negligible differences between groups fed on rations with 20% of albumen, and with 12% (Table 2).

Table 2

IFN of Two Brands of Sunflower Oil

	Experiment I	Experiment II
Check diet (sunflower oil with lard)	100.0	100.0
Voskhod sunflower oil	105±2.3	104±1.9
High-oleic sunflower oil	100±1.2	100±1.4

The bulk of biochemical data did not prove any difference between the experimental and check groups. Table 3 demonstrates some indices of lipid metabolism, and shows that the groups differ only in the cholesterin concentration in blood serum and liver. High-oleic oil provides a much lesser cholesterin concentration in serum as compared with the check group, though the quantity of linoleic acid was almost equal in their diets. However such a hypoholesteric effect was not accompanied by the accumulation of cholesterin in the liver as was the case in our experiment when superfluous quantities of linoleic acid arrived in the food. This shows the new oil brand has a positive effect. Table 4 provides data on plyenic fatty acids, with 20 and 22 carbon atoms, concentrated in erythrocyte membranes, and also CEM values. As we see, high-oleic oil provides the living organism with an adequate quan-

Table 3

Some Indices of Lipid Metabolism with Rats Fed on Different Fats

Fat used in the given diet	Blood serum (mg %)				Liver (%)		
	general lipids	cholesterin	esterified cholesterin (% of total)	phospholipids	general lipids	cholesterin	phospholipids
Lard and sunflower oil (check group)	340.0± 11.7	78.2± 3.4	125.0± 12.0	4.2±0.3	4.2± 0.3	0.27± 0.02	2.04± 0.21
High-oleic sunflower oil (I)	310.5± 21.0	62.9±[x] 4.6	81.6± 2.5	134.0± 15.5	4.9± 0.4	0.38± 0.03*	2.40± ±0.34
High-oleic sunflower oil (II)	335.0± 28.0	72.8± 5.1	72.0± 2.3	114.5± 10.4	4.8± 0.2	0.29± 0.02	2.15± 0.26

[x] r = 0.05

tity of linoleic acid, from which, by biological synthesis, arachidonic acid is got, the basic polyenic acid in the membranes. So, the new high-oleic oil has proved itself to be a valuable fat.

Experimental storage of the new oil and its experimental use in frying food demonstrated its lesser oxidation as compared with the Voskhod sunflower oil (Table 5). The data obtained show that high-oleic oil is a valuable fat and can be well used in the population's rations.

Table 4

Polyenic Fatty Acids Concentration in Rats' Erythrocite Membranes (% of sum of all fatty acids)

Fatty acids	Fats used in food		
	lard and sunflower oil (check)	high-oleic sunflower oil (I)	high-oleic sunflower oil (II)
20:3	1.21	0.82	0.84
20:4	13.80	14.27	13.37
20:5	1.39	1.15	1.34
22:3	traces	traces	0.23
22:5	1.21	1.10	1.12
22:6	1.44	2.08	1.69
CEM	2.62	2.70	2.54

Table 5

Peroxide Concentration in Oil
(% of iodine)

Oil	Peroxide concentration	
	February, 1973	December, 1973
High-oleic sunflower oil (I)[x]	0.13	0.69
High-oleic sunflower oil (II)[x]	0.09	0.22
Sunflower oil available in retail trade	-	0.37

[x]The oil was preserved in open 2-litre tanks at 3-5°C.